

WBJEE (Engineering) : 2016

(Questions with Answer Keys)

Test Booklet Code



PHYSICS

Category – I (Q.1 to Q.30)

Only one answer is correct. Correct answer will fetch full marks 1. Incorrect answer or any combination of more than one answer will fetch – ¼ marks.

1. The velocity of sound in air at 20 °C and 1 atm pressure is 344.2 m/s. At 40 °C and 2 atm pressure, the velocity of sound in air is approximately
(A) 350 m/s (B) 356 m/s (C) 363 m/s (D) 370 m/s

Solution : (B)

2. The perfect gas equation for 4 gm of hydrogen gas is
(A) $PV = RT$ (B) $PV = 2RT$ (C) $PV = \frac{1}{2}RT$ (D) $PV = 4RT$

Solution : (B)

3. If the temperature of the Sun gets doubled, the rate of energy received on the Earth Will increase by a factor of
(A) 2 (B) 4 (C) 8 (D) 16

Solution : (D) ; Comments : Temperature must be in absolute scale.

4. A particle vibrating simple harmonically has an acceleration of 16 cm s^{-2} when it is at a distance of 4 cm from the mean position. Its time period is
(A) 1s (B) 2.572 s (C) 3.142 s (D) 6.028 s

Solution : (C)

5. Work done for a certain spring when stretched through 1 mm is 10 Joule. The amount of work that must be done on the spring to stretch it further by 1 mm is
(A) 30 J (B) 40 J (C) 10 J (D) 20 J

Solution : (A)

6. If the r.m.s velocity of Hydrogen gas at a certain temperature is c , then the r.m.s velocity of Oxygen gas at the same temperature is
(A) $\frac{c}{8}$ (B) $\frac{c}{10}$ (C) $\frac{c}{4}$ (D) $\frac{c}{2}$

Solution : (C)

7. For air at room temperature the atmospheric pressure is $1.0 \times 10^5 \text{ Nm}^{-2}$ and density of air is 1.2 Kg m^{-3} . For a tube of length 1.0 m closed at one end the lowest frequency generated is 84 Hz. The value of γ (ratio of two specific heats) for air is
(A) 2.1 (B) 1.5 (C) 1.8 (D) 1.4

Solution : (D)



8. A gas bubble of 2 cm diameter rises through a liquid of density 1.75 gm cm^{-3} with a fixed speed of 0.35 cms^{-1} . Neglect the density of the gas. The co-efficient of viscosity of the liquid is
 (A) 870 poise (B) 1120 poise (C) 982 poise (D) 1089 poise

Solution : (B)

9. The temperature of the water of a pond is 0°C while that of the surrounding atmosphere is -20°C . If the density of ice is ρ , coefficient of thermal conductivity is k and latent heat of melting is L then the thickness Z of ice layer formed increases as a function of time t as

(A) $Z^2 = \frac{60k}{\rho L}t$ (B) $Z = \sqrt{\frac{40k}{\rho L}t}$ (C) $Z^2 = \frac{40k}{\rho L}\sqrt{t}$ (D) $Z^2 = \frac{40k}{\rho L}t$

Solution : (D)

10. 1000 droplets of water having 2 mm diameter each coalesce to form a single drop. Given the surface tension of water is 0.072 Nm^{-1} . The energy loss in the process is
 (A) $8.146 \times 10^{-4} \text{ J}$ (B) $4.4 \times 10^{-4} \text{ J}$ (C) $2.108 \times 10^{-5} \text{ J}$ (D) $4.7 \times 10^{-1} \text{ J}$

Solution : (A)

11. A zener diode having break-down voltage 5.6 V is connected in reverse bias with a battery of emf 10 V and a resistance of 100Ω in series. The current flowing through the Zener is
 (A) 88 mA (B) 0.88 mA (C) 4.4 mA (D) 44 mA

Solution : (D)

12. In case of a bipolar transistor $\beta = 45$. The potential drop across the collector resistance of $1 \text{ k}\Omega$ is 5 V. The base current is approximately
 (A) 222 μA (B) 55 μA (C) 111 μA (D) 45 μA

Solution : (C)

13. An electron enters an electric field having intensity $\vec{E} = 3\hat{i} + 6\hat{j} + 2\hat{k} \text{ Vm}^{-1}$ and magnetic field having induction $\vec{B} = 2\hat{i} + 3\hat{j} \text{ T}$ with a velocity $\vec{V} = 2\hat{i} + 3\hat{j} \text{ ms}^{-1}$. The magnitude of the force acting on the electron is (Given $e = -1.6 \times 10^{-19} \text{ C}$)
 (A) $2.02 \times 10^{-18} \text{ N}$ (B) $5.16 \times 10^{-16} \text{ N}$ (C) $3.72 \times 10^{-17} \text{ N}$ (D) $4.41 \times 10^{-18} \text{ N}$

Solution : (Does not match); Probable Ans : $1.12 \times 10^{-18} \text{ N}$

14. Two coils of self inductances 6mH and 8mH are connected in series and are adjusted for highest co-efficient of coupling. Equivalent self inductance L for the assembly is approximately
 (A) 50 mH (B) 36 mH (C) 28 mH (D) 18 mH

Solution : (C)

15. An $1\mu\text{F}$ capacitor C is connected to a battery of 10 V through a resistance $1\text{M}\Omega$. The voltage across C after 1 sec is approximately
 (A) 5.6 V (B) 7.8 V (C) 6.3 V (D) 10 V

Solution : (C)

16. Two equal resistances, 400Ω each, are connected in series with a 8 V battery. If the resistance of first one increases by 0.5 %, the change required in the resistance of the second one in order to keep the potential difference across it unaltered is to
 (A) increase it by 1Ω (B) increase it by 2Ω (C) increase it by 4Ω (D) decrease it by 4Ω

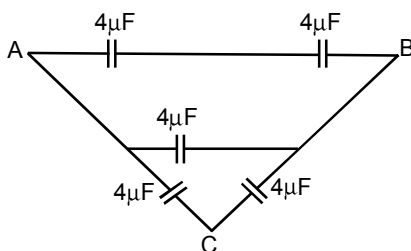
Solution : (B)

17. Angle between an equipotential surface and electric lines of force is
 (A) 0° (B) 90° (C) 180° (D) 270°

Solution : (B)



18. Equivalent capacitance between A & B in the figure is
 (A) $20 \mu\text{F}$ (B) $8 \mu\text{F}$ (C) $12 \mu\text{F}$ (D) $16 \mu\text{F}$



Solution : (B)

19. Two wires of same radius having lengths l_1 and l_2 and resistivities ρ_1 and ρ_2 are connected in series. The equivalent resistivity will be
 (A) $\frac{\rho_1 l_2 + \rho_2 l_1}{\rho_1 + \rho_2}$ (B) $\frac{\rho_1 l_1 + \rho_2 l_2}{l_1 + l_2}$ (C) $\frac{\rho_1 l_1 - \rho_2 l_2}{l_1 - l_2}$ (D) $\frac{\rho_1 l_2 - \rho_2 l_1}{l_1 - l_2}$

Solution : (B)

20. A hollow metal sphere of radius R is charged with a charge Q. The electric potential and intensity inside the sphere are respectively

- (A) $\frac{Q}{4\pi\epsilon_0 R^2}$ and $\frac{Q}{4\pi\epsilon_0 R}$ (B) $\frac{Q}{4\pi\epsilon_0 R}$ and Zero
 (C) Zero and Zero (D) $\frac{4\pi\epsilon_0 Q}{R}$ and $\frac{Q}{4\pi\epsilon_0 R^2}$

Solution : (B)

21. The potential difference V required for accelerating an electron to have the de Broglie wavelength of 1 \AA is
 (A) 100 V (B) 125 V (C) 150 V (D) 200 V

Solution : (C)

22. The work function of Cesium is 2.27 eV. The cut-off voltage which stops the emission of electrons from a cesium cathode irradiated with light of 600 nm wavelength is
 (A) 0.5 V (B) -0.2 V (C) -0.5 V (D) 0.2 V

Solution : (B); Comments : No emission occurs since photon's energy is less than work function. Hence stopping potential is meaningless. Wrong Ans : -0.2 V .

23. The number of Broglie wavelengths contained in the second Bohr orbit of Hydrogen atom is
 (A) 1 (B) 2 (C) 3 (D) 4

Solution : (B)

24. The wavelength of second Balmer line in Hydrogen spectrum is 600 nm. The wavelength for its third line in Lyman series is
 (A) 800 nm (B) 600 nm (C) 400 nm (D) 200 nm

Solution : (Does not match); Probable Ans : 120 nm

25. A ray of light strikes a glass plate at an angle of 60° . If the reflected and refracted rays are perpendicular to each other, the refractive index of glass is
 (A) $\frac{\sqrt{3}}{2}$ (B) $\frac{3}{2}$ (C) $\frac{1}{2}$ (D) $\sqrt{3}$

Solution : (D)

26. Light travels through a glass plate of thickness t and having refractive index μ . If c be the velocity of light in vacuum, time taken by the light to travel through this thickness of glass is

- (A) $\frac{t}{\mu c}$ (B) $\frac{tc}{\mu}$ (C) $\frac{\mu t}{c}$ (D) μtc

Solution : (C)

27. If $x = at + bt^2$ where x is in metre (m) and t is in hour (hr) then unit of b will be

- (A) m^2/hr (B) m (C) m/hr (D) m/hr^2

Solution : (D)

28. The vectors \vec{A} & \vec{B} are such that $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$. The angle between the two vectors will be

- (A) 0° (B) 60° (C) 90° (D) 45°

Solution : (C)

29. At a particular height, the velocity of an ascending body is \vec{u} . The velocity at the same height while the body falls freely is

- (A) $2\vec{u}$ (B) $-\vec{u}$ (C) \vec{u} (D) $-2\vec{u}$

Solution : (B)

30. Two bodies of masses m_1 & m_2 are separated by a distance R . The distance of the centre of mass of the bodies from the mass m_1 is

- (A) $\frac{m_2 R}{m_1 + m_2}$ (B) $\frac{m_1 R}{m_1 + m_2}$ (C) $\frac{m_1 m_2}{m_1 + m_2} R$ (D) $\frac{m_1 + m_2}{m_1} R$

Solution : (A)

Category – II (Q.31 to Q.35)

Only one answer is correct. Correct answer will fetch full marks 2. Incorrect answer or any combination of more than one answer will fetch – 1/2 marks.

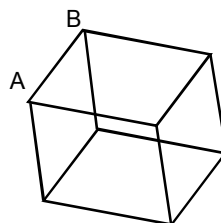
31. A mass of 1 kg is suspended by means of a thread. The system is (i) lifted up with an acceleration of 4.9 ms^{-2} . (ii) lowered with an acceleration of 4.9 ms^{-2} . The ratio of tension in the first and second case is

- (A) 3 : 1 (B) 1 : 2 (C) 1 : 3 (D) 2 : 1

Solution : (A)

32. The effective resistance between A and B in the figure is $\frac{7}{12} \Omega$ if each side of the cube has 1Ω resistance. The effective resistance between the same two points, when the link AB is removed, is

- (A) $\frac{7}{12} \Omega$ (B) $\frac{5}{12} \Omega$ (C) $\frac{7}{5} \Omega$ (D) $\frac{5}{7} \Omega$



Solution : (C)



33. A current $I = I_0 e^{-\lambda t}$ is flowing in a circuit consisting of a parallel combination of resistance R and capacitance C . The total charge over the entire pulse period is.

(A) $\frac{I_0}{\lambda}$ (B) $\frac{2I_0}{\lambda}$ (C) $I_0 \lambda$ (D) $e^{I_0 \lambda}$

Solution : (A)

34. For Fraunhofer diffraction to occur,
 (A) Light source should be at infinity (B) Both source and screen should be at infinity
 (C) Only the source should be at finite distance
 (D) Both source and screen should be at finite distance.

Solution : (B)

35. The temperature of a blackbody radiation enclosed in a container of volume V is increased from 100°C to 1000°C . The heat required in the process is
 (A) 4.79×10^{-4} cal (B) 9.21×10^{-5} cal (C) 2.17×10^{-4} cal (D) 7.54×10^{-4} cal

Solution : (Not Clear)

Category – III (Q.36 to Q.40)

One or more answer(s) is (are) correct. Correct answer(s) will fetch marks 2. Any combination containing one or more incorrect answer will fetch 0 marks. If all correct answers are not marked and also no incorrect answer is marked then score = $2 \times$ number of correct answers marked / actual number of correct answers.

36. A drop of water detaches itself from the exit of a tap when (σ = surface tension of water, ρ = density of water, R = radius of the tap exit, r = radius of the drop)

(A) $r > \left(\frac{2 R \sigma}{3 \rho g}\right)^{1/3}$ (B) $r > \frac{2 \sigma}{3 \rho g}$
 (C) $\frac{2 \sigma}{r} >$ atmospheric pressure (D) $r > \left(\frac{2 R \sigma}{3 \rho g}\right)^{2/3}$

Solution : (Does not match); Probable Ans : $r > \left(\frac{3 R \sigma}{2 \rho g}\right)^{1/3}$

37. A rectangular coil carrying current is placed in a non-uniform magnetic field. On that coil the total
 (A) force is non-zero (B) force is zero (C) torque is zero (D) torque is non-zero

Solution : (A,D)

38. A charged particle of mass m_1 and charge q_1 is revolving in a circle of radius r . Another charged particle of charge q_2 and mass m_2 is situated at the centre of the circle. If the velocity and time period of the revolving particle be v and T respectively, then

(A) $v = \sqrt{\frac{q_1 q_2 r}{4 \pi \epsilon_0 m_1}}$ (B) $v = \frac{1}{m_1} \sqrt{\frac{q_1 q_2}{4 \pi \epsilon_0 r}}$ (C) $T = \sqrt{\frac{16 \pi^3 \epsilon_0 m_1^2 r^3}{q_1 q_2}}$ (D) $T = \sqrt{\frac{16 \pi^3 \epsilon_0 m_2 r^3}{q_1 q_2}}$

Solution : (Does not match); Probable Ans : $v = \sqrt{\frac{q_1 q_2}{4 \pi \epsilon_0 m_1 r}}$, $T = \sqrt{\frac{16 \pi^3 \epsilon_0 m_1 r^3}{q_1 q_2}}$



39. The distance between a light source and photoelectric cell is d . If the distance is decreased to $d/2$ then
- (A) The emission of electron per second will be four times.
 - (B) Maximum kinetic energy of photoelectrons will be four times.
 - (C) Stopping potential will remain same.
 - (D) The emission of electrons per second will be doubled.

Solution : (A,C)

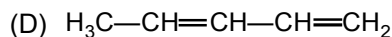
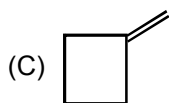
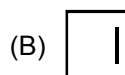
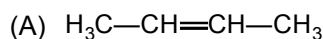
40. A train moves from rest with acceleration α and in time t_1 covers a distance x . It then decelerates to rest at constant retardation β for distance y in time t_2 . Then

(A) $\frac{x}{y} = \frac{\beta}{\alpha}$ (B) $\frac{\beta}{\alpha} = \frac{t_1}{t_2}$ (C) $x = y$ (D) $\frac{x}{y} = \frac{\beta t_1}{\alpha t_2}$

Solution : (A,B)

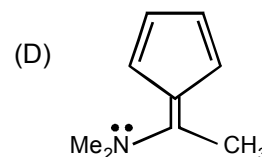
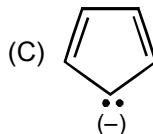
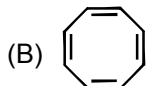
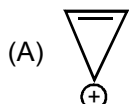


48. Ozonolysis of an alkene produces only one dicarbonyl compound. The structure of the alkene is :



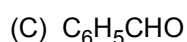
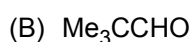
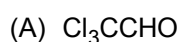
Solution : (B)

49. From the following compounds choose the one which is not aromatic :



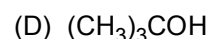
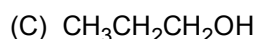
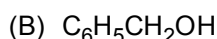
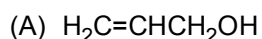
Solution : (B)

50. Amongst the following compounds, the one that will not respond to cannizzaro reaction upon treatment with alkali is



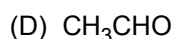
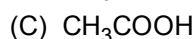
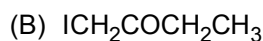
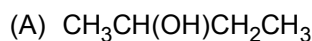
Solution : (A)

51. Which of the following compounds would not react with Lucas reagent at room temperature ?



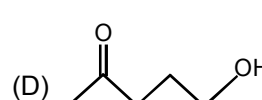
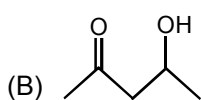
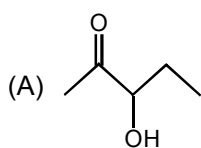
Solution : (C)

52. Amongst the following compounds the one which would not respond to iodoform test is



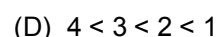
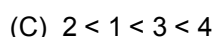
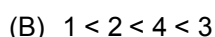
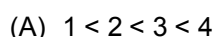
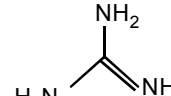
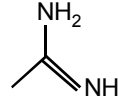
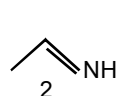
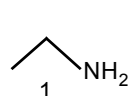
Solution : (C)

53. Which of the following will be dehydrated most readily in alkaline medium ?



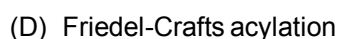
Solution : (B)

54. The correct order of basicity of the following compounds is



Solution : (C)

55. Which of the following reactions will not result in the formation of carbon-carbon bonds ?



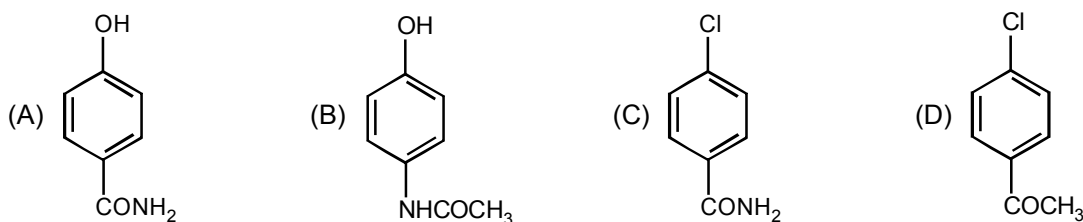
Solution : (A)



56. Point out the false statement.
- (A) Colloidal sols are homogeneous
 (B) Colloids carry +ve or -ve charges
 (C) Colloids show Tyndall effect
 (D) The size range of colloidal particles is 10 – 1000 Å

Solution : (A)

57. The correct structure of the drug paracetamol is



Solution : (B)

58. Which of the following statements regarding Lanthanides is false ?
- (A) All lanthanides are solid at room temperature.
 (B) Their usual oxidation state is +3.
 (C) They can be separated from one another by ion-exchange method.
 (D) Ionic radii of trivalent lanthanides steadily increases with increase in atomic number.

Solution : (D)

59. Nitrogen dioxide is not produced on heating
- (A) KNO_3 (B) $\text{Pb}(\text{NO}_3)_2$ (C) $\text{Cu}(\text{NO}_3)_2$ (D) AgNO_3

Solution : (A)

60. The boiling points of HF, HCl, HBr and HI follow the order
- (A) $\text{HF} > \text{HCl} > \text{HBr} > \text{HI}$ (B) $\text{HF} > \text{HI} > \text{HBr} > \text{HCl}$
 (C) $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$ (D) $\text{HCl} > \text{HF} > \text{HBr} > \text{HI}$

Solution : (B)

61. In the solid state PCl_5 exists as
- (A) $[\text{PCl}_4]^-$ and $[\text{PCl}_6]^-$ (B) covalent PCl_5 molecules only
 (C) $[\text{PCl}_4]^+$ and $[\text{PCl}_6]^-$ ions (D) covalent P_2Cl_{10} molecules only

Solution : (C)

62. Which statement is not correct for ortho and para hydrogen ?
- (A) They have different boiling points
 (B) Ortho-form is more stable than para-form
 (C) They differ in their nuclear spin
 (D) The ratio of ortho to para hydrogen changes with change in temperature

Solution : (B)

63. The acid in which O–O bonding is present is
- (A) $\text{H}_2\text{S}_2\text{O}_3$ (B) $\text{H}_2\text{S}_2\text{O}_6$ (C) $\text{H}_2\text{S}_2\text{O}_8$ (D) $\text{H}_2\text{S}_4\text{O}_6$

Solution : (C)



64. The metal which can be used to obtain metallic Cu from aqueous CuSO_4 solution is
(A) Na (B) Ag (C) Hg (D) Fe
Solution : (D)
65. If radium and chlorine combine to form radium chloride, the compound would be
(A) half as radioactive as radium (B) twice as radioactive
(C) as radioactive as radium (D) not radioactive
Solution : (C)
66. Which of the following arrangements is correct in respect of solubility in water ?
(A) $\text{CaSO}_4 > \text{BaSO}_4 > \text{BeSO}_4 > \text{MgSO}_4 > \text{SrSO}_4$
(B) $\text{BeSO}_4 > \text{MgSO}_4 > \text{CaSO}_4 > \text{SrSO}_4 > \text{BaSO}_4$
(C) $\text{BaSO}_4 > \text{SrSO}_4 > \text{CaSO}_4 > \text{MgSO}_4 > \text{BeSO}_4$
(D) $\text{BeSO}_4 > \text{CaSO}_4 > \text{MgSO}_4 > \text{SrSO}_4 > \text{BaSO}_4$
Solution : (B)
67. The energy required to break one mole of hydrogen-hydrogen bonds in H_2 is 436 kJ. What is the longest wavelength of light required to break a single hydrogen-hydrogen bond ?
(A) 68.5 nm (B) 138 nm (C) 274 nm (D) 548 nm
Solution : (C)
68. The correct order of O–O bond length in O_2 , H_2O_2 and O_3 is
(A) $\text{O}_2 > \text{O}_3 > \text{H}_2\text{O}_2$ (B) $\text{H}_2\text{O}_2 > \text{O}_3 > \text{O}_2$
(C) $\text{O}_3 > \text{O}_2 > \text{H}_2\text{O}_2$ (D) $\text{O}_3 > \text{H}_2\text{O}_2 > \text{O}_2$
Solution : (B)
69. The number of σ and π bonds between two carbon atoms in calcium carbide are
(A) one σ , one π (B) one σ , two π
(C) two σ , one π (D) one σ , $1\frac{1}{2}$ π
Solution : (B)
70. An element E loses one α and two β particles in three successive states. The resulting element will be
(A) An isobar of E (B) An isotone of E
(C) An isotope of E (D) E itself
Solution : (C)

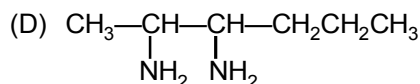
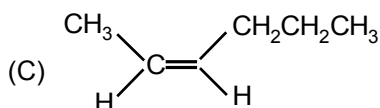
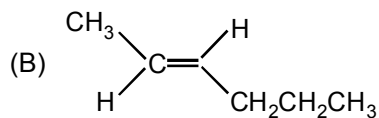
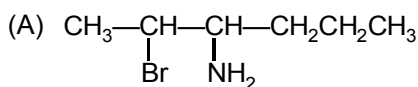
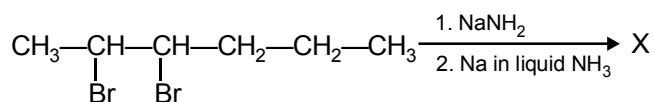
Category – II (Q.71 to Q.75)

Only one answer is correct. Correct answer will fetch full marks 2. Incorrect answer or any combination of more than one answer will fetch – ½ marks.

71. Among the following, which should have the highest r.m.s. speed at the same temperature ?
(A) SO_2 (B) CO_2 (C) O_2 (D) H_2
Solution : (D)
72. The major products obtained during ozonolysis of 2,3 – dimethyl-1-butene and subsequent reductions with Zn and H_2O
(A) Methanoic acid and 2-methyl-2-butanone (B) Methanal and 3-methyl-2-butanone
(C) Methanol and 2,2-dimethyl-3-butanone (D) Methanoic acid and 2-methyl-3-butanone
Solution : (B)



73. Identify X in the following sequence of reactions :



Solution : (B)

74. Compounds X is tested and the results are shown in the table :

Test	Result
* aqueous sodium hydroxide is added, then heated gently	Gas given off which turns damp red litmus paper blue
* dilute hydro chloric acid is added	effervescence, gas given off which turns lime water milky and acidified $\text{K}_2\text{Cr}_2\text{O}_7$ paper green

Which ions are present in compound X ?

- (A) Ammonium ions and sulphite (B) Ammonium ions and carbonate ions
(C) Sodium ions and carbonate ions (D) Ammonium ions and sulphate ions

Solution : (A)

75. The time taken for an electron to complete one revolution in Bohr orbit of hydrogen atom is

- (A) $\frac{4m^2\pi r^2}{n^2h^2}$ (B) $\frac{n^2h^2}{4\pi r^2}$ (C) $\frac{4\pi^2mr^2}{nh}$ (D) $\frac{nh}{4\pi^2mr^2}$

Solution : (C)

Category – III (Q.76 to Q.80)

One or more answer(s) is (are) correct. Correct answer(s) will fetch marks 2. Any combination containing one or more incorrect answer will fetch 0 marks. If all correct answers are not marked and also no incorrect answer is marked then score = 2 × number of correct answers marked / actual number of correct answers.

76. In which of the following mixed aqueous solutions pH=pKa at equilibrium ?

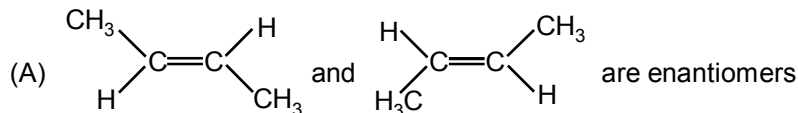
- (1) 100 ml of 0.1 M CH_3COOH + 100 ml of 0.1 M CH_3COONa
(2) 100 ml of 0.1 M CH_3COOH + 50 ml of 0.1 M NaOH
(3) 100 ml of 0.1 M CH_3COOH + 100 ml of 0.1 M NaOH
(4) 100 ml of 0.1 M CH_3COOH + 100 ml of 0.1 M NH_3
(A) (1) is correct (B) (2) is correct
(C) (3) is correct (D) both (1) and (2) are correct

Solution : (A,B,D)

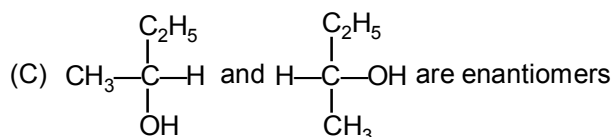
77. Amongst the following compounds, the one(s) which readily react with ethanolic KCN ?
 (A) Ethyl chloride (B) Chloro benzene (C) Benzaldehyde (D) Salicylic acid

Solution : (A,C)

78. Choose the correct statement(s) among the following



- (B) CH_3CHO on reaction with HCN gives racemic mixture



- (D) $\text{CH}_3-\text{CH}=\text{NOH}$ shows geometrical isomerism

Solution : (B,D)

79. Which of the following statement(s) is (are) correct when a mixture of NaCl and $\text{K}_2\text{Cr}_2\text{O}_7$ is gently warmed with conc. H_2SO_4

- (A) A deep red vapour is evolved
 (B) The vapour when passed through NaOH solution, gives a yellow solution
 (C) Chlorine gas is also evolved
 (D) Chromyl chloride is formed

Solution : (A,B,C,D)

80. Of the following molecules, which have shape similar to CO_2 ?

- (A) HgCl_2 (B) SnCl_2 (C) C_2H_2 (D) NO_2

Solution : (A,C)

